Vol. 14. Parts 3 & 4.

IMPERIAL MYCOLOGICAL INSTITUTE
31 JAN 1953

Rubber Research Scheme (Ceylon)

Third and Fourth Combined Quarterly Circular for 1937.

December, 1937.

H. W. CAVE & CO., PRINTERS.

Rubber Research Scheme (Ceylon).

BOARD OF MANAGEMENT.

Chairman.

The Director of Agriculture. Mr. E. Rodrigo, C. C. S. (acting)

Treasury Representative.

The Acting Deputy Financial Secretary, Mr. C. E. Jones, C.C.S.

Unofficial Members of the State Council nominated by the Governor.

Mr. George E. de Silva, M.S.C.
Mr. E. C. Villiers, M.S.C.
Mr. R. C. Kannangara, M.S.C.

Members nominated by the Ceylon Estates Proprietary Association.

Mr. J. C. Kelly
Col. T. Y. Wright.

Members nominated by the Planters' Association of Ceylon.

Mr. F. H. Griffith, M.S.C.
Mr. B. M. Selwyn.

Members nominated by the Rubber-Growers' Association.

Mr. I. L. Cameron
Mr. E. W. Whitelaw.

Members nominated by the Low-Country Products Association.

Mr. Leo B. de Mel, J.P., U.P.M.
Mr. L. M. M. Dias
Col. T. G. Jayewardene, V.D.
Mr. J. L. D. Peiris.

Members nominated by the Governor to represent Small-Holders.

Mr. F. A. Obeyesekere.
Mr. C. A. Pereira.

Experimental Committee.

Mr. F. H. Griffith, M.S.C.
Col. T. G. Jayewardene, V.D.
Mr. F. A. Obeyesekere
Mr. B. M. Selwyn
Mr. T. E. H. O'Brien (Convener)

STAFF.

Director—Mr. T. E. H. O'Bien, M.Sc., F.I.C., F.I.R.I.
Botanist & Mycologist—Mr. R. K. S. Murray, A.R.C.Sc.
Chemist—Mr. M. W. Philpott, M.Sc., A.I.R.I.
Assistant Botanist—Mr. C. A. de Silva, B.Sc., Agric (Lond.), C.D.A. (Wye)
Small-Holdings Propaganda Officer—Mr. W. I. Pieris, B.A. Hortic (Cantab)
Estate Superintendent—Mr. D. L. Nicol.
Secretary to the Director—Mr. C. D. de Fonseka.

Office and Laboratories.—Dartonfield Estate, Agalawatta, Ceylon.

CONTENTS

ORIGINAL ARTICLES

	Page
A Note on the Grey-Back Beetle or Large Cockchafer *Leucopholis* (*Lepidiota*) *pinguis* Burm. By J. C. Hutson, B.A. (Oxon), Ph.D.	36
Field Experiments on Dartonfield Estate.—V. Measurements of Growth in Replanted Areas. By C. A. de Silva	46
Notes on the Growth of Budded Trees at Nivitigalakele Experiment Station. By T. E. H. O'Brien	54
Soil Erosion in Relation to Rubber Estates. By T. E. H. O'Brien	62

MEETINGS ETC.

Minutes of the 38th, 39th and 40th Meetings of the Rubber Research Board	71

NOTICES.

DARTONFIELD ESTATE—VISITORS' DAYS

The *second* and *fourth* Wednesdays in each month have been set aside as Visitors' Days at Dartonfield Estate, and the services of Technical Officers will be available to visitors on those days. The Estate Superintendent will be available every Wednesday. Visitors are requested to arrive on the Estate not later than 9-30 a.m.

While visitors will be welcomed at the Station on other days, any particular member of the Staff may not be free to give them attention unless an appointment has been made.

Dartonfield Estate is situated about $3\frac{1}{2}$ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Leaflets, are available without charge to the Proprietors (resident in Ceylon) Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Application for registration should be made to the Director, stating the name, acreage, and registered number of the estate(s) concerned.

IDENTIFICATION OF CLONES

The attention of Proprietors and Superintendents undertaking replanting or budgrafting programmes is drawn to Planting Manual No. 5: "The History and Description of Clones of *Hevea Braziliensis*" issued by the Rubber Research Institute of Malaya, copies of which may be purchased on application to these Laboratories for Rs. 5-00 each (postage free.) This publication gives drawings and descriptive particulars of the more important clones, which should enable Superintendents to verify the authenticity of their material.

A NOTE ON THE GREY-BACK BEETLE OR LARGE COCKCHAFER

Leucopholis (Lepidiota) pinguis Burm*

J. C. HUTSON, B. A. (OXON.) PH. D.
ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE

INTRODUCTION

THE writer has been asked by the Director, Rubber Research Scheme (Ceylon) to contribute a short note on "Cockchafer Grubs" associated with young Rubber plants in order to try and clear up some of the uncertainty which seems to exist among Rubber planters that the presence of these grubs in new clearings may be connected with decaying vegetable matter. That there is some justification for this uncertainty will be evident from the following notes wherein it is indicated that there are at least two different species of large grubs to be found in young Rubber areas at the present time which bear a superficial resemblance to each other but have entirely different feeding habits. One species, the grub of the large cockchafer or grey-back (*Lepidiota pinguis*) is definitely injurious to young *Hevea* plants, while the other, the grub of the rhinoceros or black beetle of coconuts (*Oryctes rhinoceros*) is quite harmless to Rubber and is only present in replanted areas as the result of the accumulation of old Rubber stumps and logs in which it is able to breed.

As compared with our present knowledge of the habits and life-history of the rhinoceros beetle detailed in the revised leaflet No. 21 of the Department of Agriculture, the available information on the large cockchafer grub and on the grubs of its smaller relatives is scanty. Therefore the data given below on *Lepidiota* and other smaller cockchafers are mainly of a preliminary nature and are recorded here in the hope of dispelling some of the present uncertainty and of encouraging Rubber planters to make further field observations.

* The old name *Lepidiota pinguis* is retained in this article.

THE LARGE COCKCHAFER

During the early years of the present century when many new clearings were being planted in young Rubber at low and middle elevations reports were received from several districts by a former Entomologist of serious damage to the roots of young Rubber by the grubs of a large cockchafer beetle identified at that time as *Lepidiota pinguis*. These grubs had been known as pests of Cinnamon roots in some of the western and south-western low-country districts. At that time thousands of vacancies in rubber nurseries and new clearings were caused by the attacks of these grubs, but as time went on the greater part of the Rubber areas outgrew the attacks and nothing has been heard of this grub on the older Rubber estates for many years. It seems probable, however, that it has continued to breed there without doing any appreciable damage. The same grub has been reported from time to time to be troublesome in young tea clearings, especially those made from patna areas at higher elevations.

During the last few years the replanting programmes which are being carried out in many old Rubber areas have brought these *Lepidiota* grubs into prominence again as pests of seedling plants and young budded stumps both in nurseries and in replanted areas. The greatest damage to young Rubber plants seems to occur during the first few months after planting, that is during the last three months of the year, when many *Lepidiota* grubs are probably at least one-third grown and capable of serious if not vital damage to young seedlings. Budded stumps in the nursery or in the field may also be seriously injured by the older grubs.

SYMPTOMS AND NATURE OF DAMAGE

The first indication of the presence of *Lepidiota* grubs is the withering of the leaves on the seedling or young budded stump, and a slight pull usually brings the plant away in one's hand. On digging into the soil it is seen that the tap root has been cut through an inch or two below the collar and in many instances the laterals may have been completely devoured. The grub may sometimes be found within the top two or three inches of soil. If only the tap root has been cut in the early stage of a plant without injury to other roots, the seedling sometimes manages to put out at least two other small vertical roots to replace the lost tap root. Such plants usually undergo a marked

set-back in growth and can frequently be detected by their smaller size and stunted appearance as compared with uninjured plants which have gone ahead normally. There seems to be ample evidence that the grubs of *Lepidiota pinguis* are essentially feeders on the roots of living plants, frequently causing serious or even vital damage to crops of economic importance, such as Tea, Rubber, Cinnamon, Coffee, Camphor, etc. Further investigation may lead to a considerable extension of the list of food plants of the grubs.

SUGGESTED LIFE-CYCLE AND SEASONAL PREVALENCE OF *LEPIDIOTA PINGUIS*

No definite information is available as to the approximate duration of the life-cycle of the large cockchafer, since no definite attempts have been made either to study this pest in any detail or to breed it in captivity. So that at present we have to rely mainly on our old records made in connection with damage to young Rubber some thirty years ago and on a few other records of injury to other host plants scattered over the intervening period until the present time. The following tentative note indicates that this beetle may possibly under normal conditions pass through one complete life-cycle within a period of about 12 months, but that this period may possibly be extended by unfavourable climatic conditions, such as long drought, which would tend to prolong the underground stages, especially in the heavier soils.

Beetles.—Our few records of this stage (Fig. 1) indicate that the main emergence season of the beetles seems to be from February to April. We have old records of beetles emerging during September to November, but these were from light sandy soils on the western coast. Taking the early months of the year as the normal emergence season, we find that the beetles, even when appearing in vast swarms over limited areas, seem to do remarkably little damage to the leaves of garden plants and fruit trees on which they sometimes cluster in large numbers, mainly for the purpose of mating. They usually come out about dusk each evening and retire to the soil or to sheltered places before dawn. Injury to Dadap leaves has been reported from one mid-country locality and to Acacia leaves in an up-country district, but in neither instance was the damage at all serious, and so far there is no record of this large cockchafer as a pest in the beetle stage. Possibly there may be some wild host plant on which the beetles feed before mating.

Eggs and Grubs.—After about two or three weeks of feeding and mating, the females lay their eggs in the soil, probably several inches down and these eggs hatch in about two weeks or so. Grubs hatching in March remain feeding on roots in the soil until about November, and would be large enough to kill young Rubber seedlings planted at the end of the south-west monsoon, while grubs derived from beetles emerging during September to November would attack young Rubber planted at the beginning of the south-west monsoon, as our older records indicate. It may be emphasised here that it is most unlikely that *Lepidiota* grubs will breed in decaying Rubber logs or other decaying vegetable matter unless living roots of plants happen to be growing in such places. There is a possibility that they might be found in the soil under old logs if there were an adequate supply of living roots of grasses and weeds on which they could feed. *Lepidiota* grubs kept in captivity in moist decaying vegetable matter alone without living roots can just exist without making any appreciable growth over long periods, but more evidence is required on this point. During wet weather feeding seems to take place mainly within the top six inches of soil, but during drought the grubs go down deeper to obtain sufficient moisture.

Pupae and Beetles.—The full-grown grubs stop feeding and burrow down deeper into the soil, perhaps to a depth of eighteen inches to two feet, where they change into the pupa or resting stage (Fig. 1c), probably in earthen cells. This stage seems to last about four to six weeks, after which the beetles emerge inside their pupal cells where they may remain for about another month until their body covering and wing-covers have hardened. In the lighter sandy soils near the coast they are doubtless able to emerge as soon as this condition is attained, but in the heavier inland soils they may have to remain imprisoned in their cells until the first good rains at the end of March or early April have softened the soil sufficiently for their emergence.

VARIATION IN SEASONAL PREVALENCE OF *LEPIDIOTA* GRUBS

In the case of an insect, such as the large cockchafer, which normally has a long life-cycle extending over the greater part of a year and which spends most of its life in the soil, there is likely to be considerable variation in the length of the life-cycle and therefore of the seasonal prevalence from year to year, due partly to unfavourable climatic conditions and partly to the

individual variation in development which normally occurs in any species of insect with a long life-cycle. For instance, an exceptionally dry first four months of the year in districts of heavier soils would prevent the emergence of the beetles, while any long period of drought during the remainder of the year in the same districts would retard the development of the grubs considerably owing to shortage of food and lack of sufficient moisture.

Under such conditions there is bound to be a considerable over-lapping of generations and at certain times of the year it would be possible to find almost all stages of this pest at the same time in any given area.

PREVALENCE OF *LEPIDIOTA* GRUBS IN RELATION TO YOUNG RUBBER

So far as Rubber is concerned, this variation in seasonal prevalence of *Lepidiota* grubs means that at whatever time of the year young Rubber plants are coming on there will probably always be a sufficient number of these grubs present in the soil in any given area to cause appreciable damage. If nurseries and young clearings are started in April or May just before the south-west monsoon, as seems to have been done on some estates about thirty years ago, the young plants will be exposed to continuous and increasingly severe attacks by *Lepidiota* grubs for the remainder of the year due to the fact that the grubs grow in size and capacity for damage. Under the present system of replanting in felled areas of old Rubber it happens to be more suitable in many cases to start nurseries and plant felled areas in August towards the end of the south-west monsoon. This means that the young plants only have to undergo a comparatively short exposure to *Lepidiota* attacks during the last three months of the year, after which there is less risk of further serious injury, partly because most of the grubs have stopped feeding before gradually developing into beetles and partly because the plants are outgrowing the stage of serious injury by anything but the few remaining older *Lepidiota* grubs of that season. Plants which escape injury during the first year in the nursery or in the field may be attacked later as budded stumps, but are less liable to vital injury in their second and third years.

OTHER COCKCHAFER GRUBS FOUND IN RUBBER AREAS

Apart from *Lepidiota* grubs, there are grubs of several species of smaller cockchafer beetles which abound in Ceylon

soils. None of these species of grubs, so far as is known, ever becomes large enough to do any vital damage to young Rubber plants, except possibly to quite young seedlings up to a month or so after germination if they happen to occur in sufficient numbers in a small area. Some species of these smaller cockchafer grubs may not be root-eaters, but may feed almost entirely on decaying vegetable matter in the soil and may sometimes abound in soils rich in humus. Nothing definite is known about the life-history of any of these smaller cockchafer beetles except that some of them may have a comparatively short active larval or grub period and may remain for some six months or so as inactive full-grown grubs in the soil before pupating and changing into beetles.

THE RHINOCEROS OR BLACK BEETLE

(*ORYCTES RHINOCEROS* L.)

In addition to these numerous species of smaller cockchafer grubs there is a species of large grub which seems to be becoming increasingly numerous in these replanted Rubber areas. This is the grub of the rhinoceros or black beetle which although not a cockchafer, is related to *Lepidiota*, since it belongs to another sub-family of the same large family *Scarabaeidae*. The felling of large areas of old Rubber trees, resulting in the accumulation of decaying Rubber logs and stumps, has led to an increase in the number of rhinoceros beetles, the grubs of which breed not only in masses of decaying vegetable matter but in any old decaying logs and stumps, including those of *Hevea*. The increase of these *Oryctes* grubs in Rubber areas where old logs and stumps have not been disposed of has more or less coincided with the increase of *Lepidiota* grubs in the same Rubber areas, where young Rubber is being planted, and in adjoining nurseries. The increase of *Oryctes* grubs in these areas has given rise to the belief that it is these grubs which are killing young Rubber seedlings in nurseries and in replanted areas, since there is a close superficial resemblance between *Oryctes* and *Lepidiota* grubs, but such a belief is entirely erroneous.

These rhinoceros beetle grubs are not known to feed on the living roots or other living tissues of any plants, but only on decaying vegetable matter. The damage to young Rubber plants is being done by *Lepidiota* grubs, which are essentially feeders on the living roots of *Hevea* and other plants, and by other smaller cockchafer grubs with similar habits, as has been previously explained, and *Lepidiota* grubs are probably one of the commonest

species of cockchafer grub to be found at present in young Rubber areas. If *Oryctes* grubs are also found in such areas, they are there to feed on any cattle manure or other decaying organic matter with which the young Rubber plants may have been supplied; any injury caused by these *Oryctes* grubs to the roots of young Rubber would be quite accidental and negligible. Therefore the increase in the number of *Oryctes* grubs in replanted Rubber areas can in no way be considered a menace to the young Rubber, but would be a danger to any adjoining coconut palms to which the rhinoceros beetles would fly for feeding before laying their eggs in decaying refuse. These beetles are known to feed only on palms of various kinds and cannot damage Rubber trees in any way. Therefore the rhinoceros beetle in any stage of its development is not injurious either to young or old Rubber trees.

The increase of the rhinoceros or black beetle in the felled Rubber divisions of mixed Rubber and Coconut estates is, however, a distinct menace to the Coconut divisions of such estates and to any adjoining coconut areas, especially of young palms, since, as previously indicated, the *Oryctes* grubs can breed extensively in old Rubber logs and stumps left decaying on the ground in replanted areas. The beetles emerging from such breeding places will fly to the nearest Coconut palms which they can damage seriously by boring into the crowns to feed on the sap exuding from the wounds. The rapid increase of black beetle in any given Coconut area as a result of these invasions will lead indirectly to an increase of the red weevil, which in the grub stage is capable of killing young palms and of causing serious injury to older ones, as indicated in revised leaflet No. 22 of the Department of Agriculture.

Therefore those Superintendents who have felled, or intended to fell, old Rubber on mixed estates or on estates adjoining Coconut areas are strongly urged to make every effort to dispose of their old Rubber logs and stumps as rapidly as possible, otherwise under damp conditions these will become attractive breeding places for *Oryctes* grubs within a few weeks after felling.

THE GREY-BACK BEETLE OF RUBBER OR LARGE COCKCHAFER AND THE RHINOCEROS OR BLACK BEETLE OF COCONUTS

The following notes are intended to indicate the external differences in appearance between the various stages of the

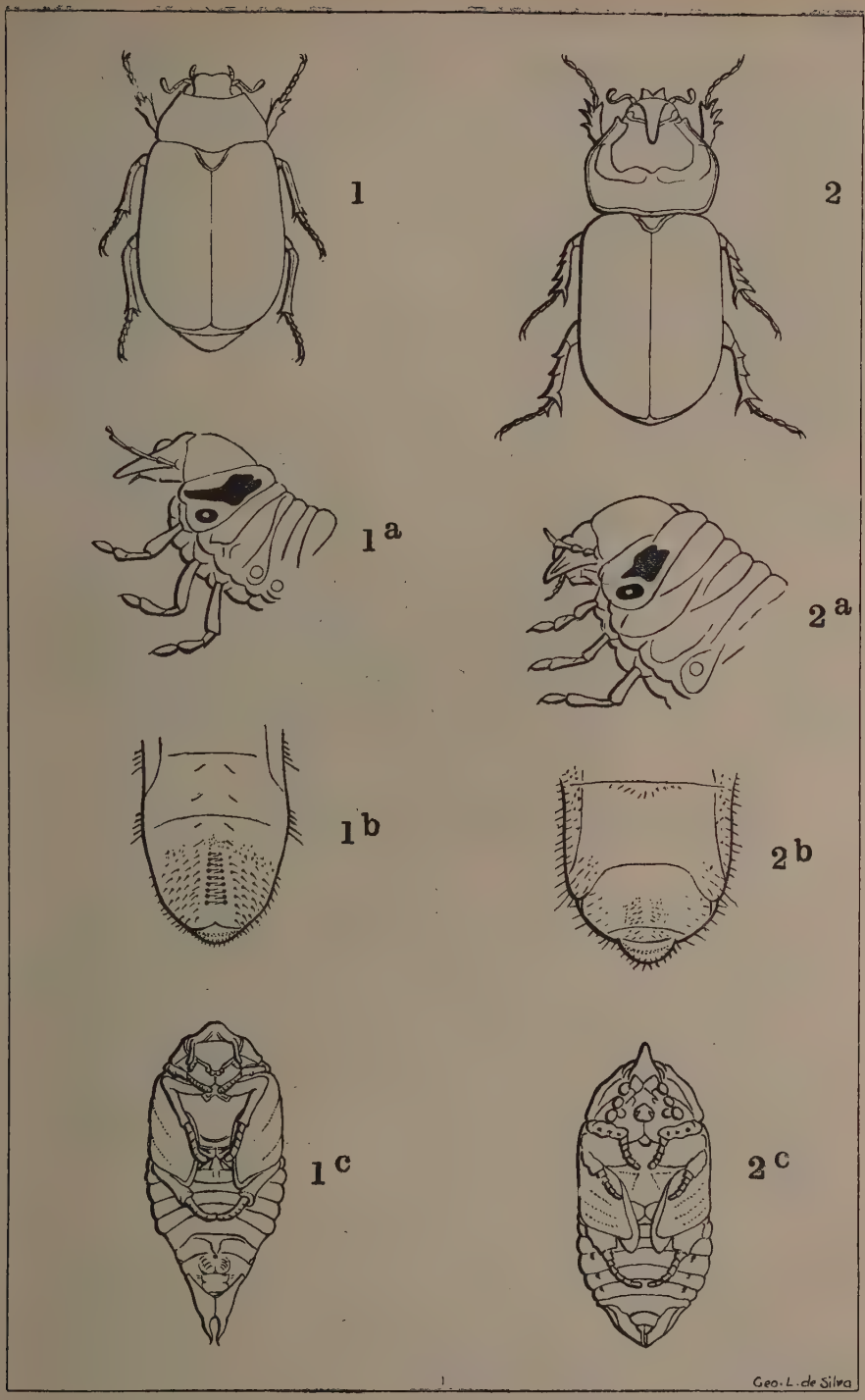
above beetles so that those who are interested may, after a little examination, be able to identify the particular pest with which they have to deal.

Beetles.—(Figures 1 and 2). Freshly emerged grey-backs (*Lepidiota*) are either dull grey to greyish-white or dull greyish-brown to brownish in colour and it is understood from Mr. G. M. Henry of the Colombo Museum that the greyish beetles are usually females, while the brownish ones tend to be males. Additional evidence of the correlation between colour and sex seems to be afforded by Mr. J. A. Pye, a former resident of Kakkapalliya near Chilaw. During unusual swarms of these beetles which clustered in masses on his garden plants on several successive evenings during February, 1935 he noticed that the comparatively few greyish beetles, which he took to be females, were each surrounded by several brownish beetles assumed to be males. The colour of these *Lepidiota* beetles is due to a covering of innumerable small scales or modified hairs. Older beetles which have been out for some time often lose most of these scales from their wing-covers which are seen to be dark chestnut-brown to almost blackish and somewhat shiny.

The black beetle (*Oryctes*) has rather a glossy appearance and is not covered with scales, but the underside of the body is thickly clothed with reddish-brown hairs. The body colour ranges from dark chestnut-brown to almost black; the male usually has a longer horn than the female.

Eggs.—The eggs of the grey-back are somewhat similar to those of the black beetle illustrated in Figure 2 of leaflet No. 21. The eggs of either species are rarely seen unless a special search is made for them when the beetles are numerous.

Grubs.—The full-grown *Lepidiota* grub shows a general resemblance to a mature *Oryctes* grub depicted in Figure 5 of the Department of Agriculture leaflet No. 21, in that they both have three pairs of rather long, jointed legs, a brown head with a pair of powerful jaws and a rather fat, soft, somewhat cylindrical body, with a much wrinkled skin, and both usually lie in semi-circular position. A rough and ready method of distinguishing them is to put a grub on the top of the soil and watch its progress. *Lepidiota* crawls along dragging its fully extended body after it for a short distance and seems to be in no special hurry to hide, whereas *Oryctes* is unable to straighten its body and crawl, but tumbles about awkwardly and very soon buries itself in the



The Grey-back Beetle of Rubber or Large Cockchafer (*Lepidiota pinguis*)
and
The Rhinoceros or Black Beetle of Coconuts (*Oryctes rhinoceros*)

Fig. 1. Grey-back Beetle. Fig. 2. Black Beetle. Fig. 1a. Front portion of *Lepidiota* grub showing characteristic shape of lateral plate. Fig. 2a. The same for Oryctes grub. Fig. 1b. Ventral surface of hinder end of *Lepidiota* grub showing characteristic double row of small spines. Fig. 2b. Same for *Oryctes* grub showing arrangement of small spines and hairs. Fig. 1c. Pupa of *Lepidiota*. Fig. 2c. Pupa of *Oryctes*. Figs. 1a, 2a, 1b, 2b slightly enlarged; other figures natural size.

soil where it evidently feels more at home. The *Lepidiota* grub at this stage is usually creamy white, but *Oryctes* is bluish-grey at the hinder end which is noticeably stouter than the head end. Other characteristic differences between the two grubs are shown in the accompanying plate. Figures *1a* and *2b* illustrate the different shapes of the pale-brownish lateral patches or plates, while figures *1b* and *2b* show the characteristic arrangement of the small hairs and spines on the ventral surface of the end of the body. The above two sets of characters (*i.e.*, the shape of the lateral plates and the grouping of the ventral spines and hairs) seem to be constant for all ages and sizes of the two species of grubs and, with the help of a lens, provide final tests for separating them, especially in the case of young grubs which otherwise bear a much closer resemblance to each other than do the older grubs of these two beetles.

Pupae.—These are not often found, as they are usually enclosed in earthen cells, sometimes at a depth of eighteen inches to two feet. Both kinds of pupae are brownish, as shown in Figure 6 of leaflet No. 21, but in the case of *Oryctes* the future horn can be seen projecting beyond the top of the head.

CONTROL MEASURES FOR *LEPIDIOTA PINGUIS*

The only control measure carried out on estates at present seems to be the removal and destruction of those grubs which have killed young *Hevea* plants, and many such grubs probably escape detection. If this measure is carried out systematically in a nursery during the last four months of each year and continued for a month or two into the next year, if necessary, it should be possible to save a number of young plants, since a single grub probably destroys several seedlings during this period. At the present time no really practical and effective method of controlling the grubs can be recommended.

It is understood that preliminary trials are being carried out by the Rubber Research Scheme by incorporating various chemical substances in the soil in which young *Hevea* plants are grown, mainly with the object of first testing their effect on the plants. The less injurious ones may then be used to try and prevent serious attack by *Lepidiota* grubs in nurseries and new clearings.

The beetles can sometimes be collected and destroyed if found clustering on low-growing plants, but this measure would be of little value unless done systematically during periods of prevalence.

No natural enemies of the grubs have been observed so far, and the possibilities of control by importing parasites is worth investigating, since various species of wasps are known to be of some value against relatives of *Lepidiota pinguis* in other countries.

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—V. MEASUREMENTS OF GROWTH IN REPLANTED AREAS

C. A. DE SILVA,
ASSISTANT BOTANIST.

IN previous R. R. S. *Quarterly Circulars* [1, 2, 3], accounts are given of experimental areas replanted on Dartonfield in 1934, 1935 and 1936 respectively. Periodical measurements of growth have been made in these clearings, and the following notes summarise the results and conclusions to date.

The experiments were designed so that not only the main treatment effects but also any interactions between the treatments could be computed, but in these early analyses possible interactions have been ignored as the main effects have, in most cases, barely reached a standard of significance.

For detailed descriptions of the experimental designs the reader is referred to the articles given in the references, but the treatments under comparison are recapitulated for each area.

1934 REPLANTING

The area is $7\frac{1}{2}$ acres and is divided into three blocks (replications) planted respectively with Clones Glenshiel 1, A.V.R.O.S. 256 and Prang Besar 25. Each block is divided into 4 strips running from top to bottom of the hill-side planted respectively with the following ground covers:—

1. *Centrosema pubescens*
2. *Pueraria phaseoloides*
3. *Calopogonium mucunoides*
4. *Dolichos Hosei* (*Vigna*).

At right angles to these strips each block is divided into 3 plots with the following methods of dealing with the old Rubber timber:—

α Leaving all large timber lying unburned.

β Burning all timber *in situ*.

γ As β but removing and burning all the larger lateral roots.

The "plaid shawl" arrangement arising from these strips and plots at right angles to one another results in unit plots of 16 trees, and each such plot is divided into two sub-plots with different methods of controlling the ground cover, as under:—

X Keeping individual platforms (15 feet long) clean weeded.

Y Ring-weeding in a 6 feet circle round each tree.

The measurements in the years 1936, and 1937 were in each case made in September when the plants were exactly 2 and 3 years old respectively, the age being calculated from the date of cutting back the stock. The figures include all later supplies but exclude the "barrier" trees round the margin of the field.

The growth for the three clones is given in Table I. The comparison cannot be interpreted statistically as there is no replication, but the figures are of interest as showing the general level of growth. The mean girth increase for the year 1936-37 of 3.88 ins. can be considered very satisfactory. Glenshiel 1 is undoubtedly a less vigorous clone than the others in this type of soil.

TABLE I

Clone	Mean girth in ins. at 3 ft from union		
	1936	1937	Increase
Glenshiel 1	5.09	8·54	3.45
A. V. R. O. S. 256	5.63	10.00	4.37
Prang Besar	5.05	8.88	3.83
General Mean	5.26	9.14	3.88

Table II gives the figures for the three series of comparisons, the significance, or otherwise, of the differences being indicated.

TABLE II

TREATMENTS	Mean girth in inches at 3 ft. from union		
	1936	1937	Increase
Species of Cover (Blocks 3, Plots 4)			
Centrosema pubescens	5.16	8.93	3.77
Pueraria phaseoloides	4.95	8.61	3.66
Calopogonium mucunoides	5.51	9.36	3.85
Dolichos Hosei (Vigna)	5.43	9.66	4.23
Mean	5.26	9.14	3.88
Standard. error	—	—	.06
Significant difference (.05 Probability)	Not significant	—	.20
Timber Treatments (Blocks 3, Plots 3.)			
α Leaving all large timber lying unburned	5.38	9.38	4.00
β Burning all timber *in situ*	5.19	9.16	3.97
γ as β, but removing and burning all the larger lateral roots	5.22	8.88	3.66
Mean	5.26	9.14	3.88
Differences	Not significant	—	Not significant
Control of Cover. (36 comparisons)			
Keeping platforms clean weeded	5.30	9.17	3.87
6 feet circle kept clean round each tree	5.22	9.10	3.88
Mean	5.26	9.14	3.88
Differences	Not significant	—	Not significant

The statistical analyses for 1937 have been based on the figures for increase in girth. The only difference which is significant, *i.e.*, is very unlikely to be due to chance, is the superior growth in the strips planted with Vigna as compared with the more vigorous covers. There is also an indication that Calopogonium may be less competitive than Pueraria, the difference in the growth rate for 1936-37 only just failing to reach the level of significance.

The difference between Vigna and the other species shows that some competition between the Rubber plants and the ground cover has existed, and it is perhaps surprising to find no difference between the two methods of controlling the covers. It would appear that under the conditions of the experiment it is unnecessary to clear away the cover further than 3 feet from the plant, *i.e.*, in a circle 6 feet in diameter, but two qualifying factors must be mentioned. In the first place the platforms have received regular and fairly generous applications of artificial fertilisers so that there has been plenty of food for both root systems, and secondly the cover has been cut back and forked into the platforms (also outside the platforms in 1936 and 1937) once a year.

The results of the timber treatments remain inconclusive. Owing to the small number of replications the experimental error is high, and it is possible that had the comparison been a more accurate one the indication of poorer growth where the roots have been removed might have received statistical support.

There have been two cases of *Fomes lignosus* in this area, one in a plot where the timber was left unburned and the other where the timber was burned, but large laterals were left in the ground. These isolated cases, however, hardly warrant an interpretation in favour of root removal.

1935 REPLANTING

The area is 13½ acres and is divided into four blocks (replications) planted respectively with clones Tjirandji 1, Bodjong Datar 5, Wawulugala 259 and Hillcroft 28. Each block is divided into 9 plots according to the following 9 fertiliser treatments:—N_1, N_2, N_1P, N_2P, N_1K, N_2K, N_1PK, N_2PK, O.

N = Nitrogen
P = Phosphoric acid
K = Potash
O = Control

It is seen that each nutrient is given at two levels, nitrogen at unit and double doses, and phosphoric acid and potash at nil and unit doses, with every possible combination between these treatments.

Each plot of 16 trees is divided into two sub-plots, in one of which the green cover is forked in together with the fertiliser while in the other the cover is simply spread on the surface.

Unfortunately the presence of a "rogue" was detected in the Tjirandji 1 block and this replication cannot at present, therefore, be taken into account.

Table III gives the measurements for the several clones, the comparison being unreplicated.

In this field the plants are measured in July, the planting of budded stumps having been carried out in June-July 1935.

TABLE III

Clone	Mean height in ft. 1936	Mean girth in ins. 1937
Tjirandji 1	—	—
Bodjong Datar 5	6.58	4·72
Wawulugala 259	7.10	4.94
Hillcroft 28	6.67	5.16
General Mean	6.78	4.94

Table IV gives the mean figures for the respective fertiliser treatments — height in feet in 1936 and girth in inches at 3 feet from the union in 1937.

TABLE IV

	Year	N_1	N_2	N_1P	N_2P	N_1K	N_2K	N_1PK	N_2PK	O	General Mean.
Mean height in ft.	1936	5·63	6·72	6·25	7·10	7·34	8·25	6·31	6·45	6·97	6·78
Mean girth in ins.	1937	4.34	4.81	4.92	5.04	5.02	5.33	4.84	5.22	4.97	4.94

Table V gives the means for the sub-plot treatments.

TABLE V

	Mean girth in 1937
Green loppings forked in ...	4.95 ins.
,, ,, not forked in ...	4.83 ,,
	Not significant

An analysis of variance indicates that the treatment effect is not significant in either 1936 or 1937. Although the precision of the experiment has been reduced by the elimination of one replication it is nevertheless evident that under the particular local conditions there has been little or no response to manure in the first two years. The soil in this particular field is of more than average fertility, and it would appear that the good top soil with which the holes were carefully filled has been sufficient to maintain a fair rate of growth for the first two years. At the time of writing, however, differences in the appearance of the foliage are becoming evident, the plants in the O plots putting on very little new growth.

It would be dangerous to conclude from the early results of this one experiment that fertiliser applications to budded stumps during the first two years are usually uneconomic in replanted areas, and until further evidence becomes available the recommendation to apply complete mixtures starting from the planting hole holds good.

1936 REPLANTING

The area is approximately 10 acres in extent and is divided into four main blocks each of which has been planted with a different clone. The clones are A.V.R.O.S. 49, Prang Besar 25, Sungei Reko 9 and Rubana 393. Each block is divided into 3 sub-blocks for comparing 3 methods of opening, viz. contour trenches, contour platforms and contour pitted drains. Each sub-block is further divided into 3 plots, which are planted in three different systems:—

A. Planting budded stump.

B. Planting stumped buddings.

C. Seed at stake for budding in the field.

Finally, each plot is divided into 2 sub-plots for comparing organic and inorganic fertilisers. A sub-plot, which is the smallest unit in the layout, consists of a group of 12 plants. The two year old budgrafts (stumped buddings) and budded stumps were planted at the end of May, 1936 and seedling plants in September, 1936. Five seedling plants in each hole were thinned out to three plants and the height measurements were taken in March, 1937. The height measurements of all budded stumps were made in June, 1937 and finally, in July, 1937, the seedling plants were further thinned out to 2 plants per hole

and height measurements taken again in October, 1937. Although preliminary measurements were made in June, 1937 of the stumped buddings, it is premature to use these figures for statistical calculations. The results for the comparisons of the three methods of opening have been worked out independently for the two systems of planting, *i.e.*, budded stumps and seed at stake. In doing so, the plots corresponding to the three methods of opening do not form strictly contiguous series within the main blocks, as the third system of planting, *i.e.*, stumped buddings has been excluded from each replication. It would, therefore, be incorrect to eliminate block errors, and in the analysis of variance these have been included in the estimate of experimental errors. This procedure avoids the risk of underestimating experimental error and adjudging differences significant, where block errors are not eliminated by experimental design. This is purely a temporary phase in this experiment, and will disappear when girth measurements of budgrafts are available for all three systems of planting.

Table VI gives the mean figures for the comparison between the three methods of opening.

TABLE VI

Methods of Opening

Replications 4.
Treatments 4.

	Seedling Plants		Budded Stumps
	Average height in inches March, 1937	Average height in feet October, 1937	Average height in feet June 1937
Contour trenches	35.2	8.11	12.44
Contour platforms	34.2	7.98	11.00
Pitted drains	29.2	6.53	10.25
Mean	32.8	7.54	11.23
Standard. error		.367	
Significant difference (.05 probability)	Not significant	1.17	Not significant

Table VII gives the mean figures for the 2 fertiliser treatments.

TABLE VII Manurial Treatments (12 comparisons)

	Seedling Plants		Budded Stumps
	Mean height in inches March 1937	Mean height in feet October 1937	Mean height in feet June, 1937
Organic	32.7	7.41	11.62
Inorganic	32.9	7.65	10.84
Mean	32.8	7.53	11.23
Standard Error	—	—	.24
Significant difference (.05 probability)	Not significant	Not significant	.75

In the case of the heights of seedling plants made in October, 1937, the results give significant differences in favour of contour trenches and platforms as compared with drains. In the case of budded stumps the difference between trenches and drains is just not significant owing to inclusion of block error, but taking the two series together the results strongly indicate that in the first year the order of growth is: trenches — platforms — drains. The poorer growth in the pitted drain plots might be explained by the fact that the young plants are less easily kept isolated from vigorous growing cover than in trenches and on platforms.

The effects of organic and inorganic treatments remain inconclusive, although in the case of budded stumps the difference is just significant. In the latter case, however, the difference of about 10 ins. would hardly be sufficient to justify the extra cost of the more expensive organic mixture.

The mean height of the plants put out as budded stumps — 11.23 feet in 12 months — may be considered very satisfactory for replanting on somewhat poor land.

REFERENCES

(1) *Quarterly Circular* of the Rubber Research Scheme (Ceylon) 1934 Vol. 11, Parts 3 and 4 (p. 56).

(2) *Quarterly Circular* of the Rubber Research Scheme (Ceylon) 1936, Vol. 13, Parts 2 and 3, (p. 66).

(3) *Quarterly Circular* of the Rubber Research Scheme (Ceylon) 1936, Vol. 13, Part 4, (p. 91).

NOTES ON THE GROWTH OF BUDDED TREES AT NIVITIGALAKELE EXPERIMENT STATION

T. E. H. O'BRIEN,
DIRECTOR.

NIVITIGALAKELE Experiment Station, Matugama, was opened in 1926 for the purpose of testing the budded progeny of high-yielding Ceylon estate trees. Clearings totalling 61 acres were planted in 1926, 1927 and 1928 and budding was spread over the period 1927-1932. The contour platform system of planting was adopted except for 4 acres of the 1928 clearings which were opened on the contour trench system. A further clearing of 28 acres was opened on the latter system in 1935 but this area is not included in the present review. 125 local clones are under trial in the earlier clearings and 45 in the new clearing.

The soil in most parts of the station is very poor, consisting of a gravelly lateritic soil with a hard pan of laterite a few feet below the surface. The clearings were manured in 1929 (28 acres), 1931, 1934 (38 acres), 1935 and 1936.

Girth measurements of the trees taken in June, 1937 have been tabulated in a form showing the number of trees in different girth classes in relation to age from the time of budding or supplying. The figures, together with notes on the history of the clearings, are reproduced as being of general interest.

1926 CLEARING 12 ACRES

Planted in June 1926 with seedling stumps supplied from Peradeniya. Budding was started in 1927 and continued in 1928 and 1929. Budding results were very disappointing and it is now known that this is to be expected with transplanted stumps. A large number of plants were replaced by budded stumps in 1929 and 1930.

1927 CLEARING 16 ACRES

Planted with basket plants. Budding was carried out in 1928, 1929 and 1930. Plants not successfully budded were replaced by budded stumps in 1930 and 1931.

1928 CLEARING 33 ACRES

Planted partly with seed at stake (3 per hole) and partly with basket plants. A decision to reduce the size of plots from 100 to 30 trees with a view to testing a larger number of mother trees, led to delay in budding part of the clearings owing to shortage of budwood. Budding was undertaken in 1930, 1931 and 1932. A certain amount of supplying was done in subsequent years.

UNBUDDED TREES

A girth table of miscellaneous unbudded trees on the Station is included for purposes of record.

GIRTH TABLE No. 1. 1926 CLEARING

Date of budding or supplying	Girth in inches										
	Less than 18 in.	18/21	21/24	24/27	27/30	30/33	33/36	36/39	39/42	More than 42	Total Trees
1927	14	19	30	39	57	31	21	13	3	1	228
1928	6	7	29	27	38	24	13	2			146
1929	97	102	147	152	165	60	16	2			741
1930	49	8	4	1		1					63
	166	136	210	219	260	116	50	17	3	1	1178

Trees dead, blown down, etc.	...	27
Trees removed for building sites	...	19
Total as per planting records	...	1224

GIRTH TABLE No. 2. 1927 CLEARING

Date of budding or supplying	Girth in inches									Total Trees
	Less than 18 in.	18/21	21/24	24/27	27/30	30/33	33/36	36/39	39/42	
1928 ...	20	27	72	51	53	49	16	6	1	295
1929 ...	34	75	152	159	23	56	14	1		614
1930 ..	136	158	153	62	14	2	1			526
1931	99	21	12	3		1				136
	289	281	389	275	190	108	31	7	1	1571

Trees dead, blown down, etc. ... 15

Trees removed for building sites, cart road, etc. 31

Total as per planting records ... 1617

GIRTH TABLE No. 3. 1928 CLEARINGS

Date of budding or supplying	Less than 18 in.	Girth in inches 18/21	21/24	24/27	27/30	30/33	33/36	36/39	39/42	Total Trees
1930 ...	170	213	300	162	58	14	6			923
1931 ...	490	351	160	42	6					1049
1932 ...	502	33	9	2						546
1933 ...	59	1								60
1934 ...	22									22
1935 ...	13									13
	1256	598	469	206	64	14	6			2613

Seedling trees (see below)	...	52
Vacancies ...	...	59
Total as per planting records	...	2724

GIRTH TABLE No. 4. COMBINED TABLE. 1926, 1927 & 1928 CLEARINGS

Date of budding or supplying	Less than 18 in.	18/21	21/24	24/27	27/30	30/33	33/36	36/39	39/42	More than 42	Total	Per cent Tappable
	Girth in inches											
1927 ...	14	19	30	39	57	31	21	13	3	1	228	93.9
1928 ...	26	34	101	78	91	73	29	8	1		441	94.1
1929 ...	131	177	299	311	288	116	30	3			1355	90.3
1930 ...	355	379	457	225	72	17	7				1512	76.5
1931 ...	589	372	172	45	6	1					1185	50.3
1932 ...	502	33	9	2							546	8.8
1933 ...	59	1									60	
1934 ...	22										22	
1935 ...	13										13	
	1711	1015	1068	700	514	238	87	24	4	1	5362	

GIRTH TABLE No. 5. MISCELLANEOUS UNBUDDED TREES

Date of planting	Girth in inches										Total Trees
	Less than 18 in.	18/21	21/24	24/27	27/30	30/33	33/36	36/39	39/42	More than 42	
1925 (Control trees in 1927 clearing)				1	1	1	2	3	1	3	12
1927 (Control trees in 1926 clearing)		1	2	3	1	2	1	3	1	3	17
1927 (Marcots in 1927 clearing)				3	9	11	14	16	10	8	71
1928 (Marcots in reservation area)	1	4	1	7	3	1					17
1928 (Control plots in 1928 clearing)	7	4	7	8	12	10	4				52
1932 (Tjikado seedlings in reservation area)	125	32	6	1							164
							Vacancies	...	...		7
							Total	...	...		340

The standard of growth adopted in connection with the special assessment of budded Rubber in Ceylon under the Rubber Restriction Ordinance is shown in the following Table (No. 6) the age of the trees being calculated from the date of budding or planting out budded stumps:—

TABLE No. 6

Age	Girth
5 years ...	18 inches
6 ,, ...	21 ,,
7 ,, ...	24 ,,
8 ,, ...	27 ,,
9 ,, ...	30 ,,

In practice, it is found that budded Rubber areas in Ceylon which have been assessed up to the present do not attain this standard of growth. Speaking from experience as a member of the Assessment Board the writer can say that the rate of growth is usually more than a year behind the scale and that on an average estate 50 per cent of the trees reach a girth of 18 inches in six years. Table No. 7 shows the extent to which the budded trees at Nivitigalakele conform to a growth rate of 3 inches per annum.

TABLE No. 7

Year of budding or supplying	Total number of trees	Age in 1937	Standard girth at 3 in. growth per annum	Number of trees which have attained the standard girth	per cent
1927 ...	228	10	30 inches	69	30.7
1928 ...	441	9	27 ,,	202	45.8
1929 ...	1355	8	24 ,,	748	55.2
1930 ...	1512	7	21 ,,	814	53.8
1931 ...	1185	6	18 ,,	596	50.3

The conclusion is reached from these figures that the rate of growth at Nivitigalakele approximately conforms to the local standard for clearings planted during the same period. Planting methods have improved and knowledge of the requirements of young budded trees has increased substantially in recent years and it may be anticipated that many of the areas which are now being replanted will maintain a better standard of growth than that achieved in earlier plantings in virgin soil, provided that the importance of regular and frequent manuring is adequately recognised. Requirements will vary according to conditions on different estates and the general aim in arranging manuring programmes should be to maintain a minimum average girth increment of 3 inches per annum.

SOIL EROSION IN RELATION TO RUBBER ESTATES.*

T. E. H. O'BRIEN,
DIRECTOR.

I am very glad to have the opportunity of meeting the members of this association again. The last time I attended a meeting of the Matale Planters' Association was the occasion of Mr. R. K. S. Murray's first lecture on Oidium leaf disease and I am very glad to say that the work he has since carried out on the subject has resulted in the widespread adoption of measures for the control of the disease.

My subject, today, is soil erosion in relation to Rubber estates and it is one which really requires very little introduction. Soil erosion may be defined as the corrosive action of natural forces on the surface of the earth. It may be caused by various agencies such as water, wind or ice, but so far as local Rubber is concerned the erosive effect of water is the only important factor. There are two aspects from which erosion may be considered, namely, the internal aspect: that is the damage caused to the land eroded, and the external aspect: that is the damage caused to other areas by flooding or the deposition of silt from the eroded area. I shall confine myself today to the internal aspect although the question of external damage is of obvious importance to the general community.

Before dealing with specialized aspects of the subject I should like to place before you a few quotations from authorities on soil erosion with a view to emphasizing that the problems of soil erosion are not peculiar to Ceylon but have to be faced in all parts of the world and that the neglect of adequate protective measures in the past has lead to the devastation of vast tracts of agricultural land and has played an important part in shaping the history of the world.

1. "It is now appreciated that the disappearance of certain ancient civilizations is due to the conversion of what were once fertile lands carrying a dense and highly civilized population,

* Address to the Matale District Planters' Association, June 12, 1937.

into deserts, produced not by a change in climatic conditions but by man's ignorance and lack of foresight in his treatment of the soil."

2. "China is a striking example of the misuse of land with consequent erosion — due to having no land policy. The population is now packed on a limited area of alluvial soil where floods bring frequent disaster. China's decline as a nation is coincident with loss of productive land."

3. "Today millions of acres of the Imperial domain all over the world are in danger of destruction by the uncontrolled forces of erosion. In many parts huge areas are losing their original fertility; in others, immense tracts of once valuable land have already reverted to desert, while many more are 'on the way.' "

4. "It takes 400-500 years to produce an inch of top soil which may be lost in one year on a steep slope, in 3 years on a moderate slope poorly managed or in one rainfall of the cloud burst type."

These quotations are reproduced from the annual report of the Director of the Rubber Research Institute of Malaya for 1935 but equally apt illustrations of the destruction caused by soil erosion may be found in the report of the Committee on Soil Erosion in Ceylon, which was published in 1931 and which I hope you have all read. As early as 1873 attention was drawn to the denudation of the soil which was occurring in Ceylon as the result of the indiscriminate clearing of land for Coffee and Tea estates. Reference is made in the report to the successive occasions on which the need for measures for the prevention of erosion has been stressed by various Committees and Commissions. The Soil Erosion Committee investigated the subject very thoroughly and made a series of recommendations which merit the careful attention of all concerned with local agriculture. I am pleased to say that the Minister for Agriculture and Lands has recently announced his intention of appointing a special officer to co-ordinate work on soil erosion and is also contemplating the introduction of an ordinance insisting on approved soil conservation measures being taken when land is cleared for planting.

I would also like to draw your attention to a very useful leaflet recently issued by the Department of Agriculture (soil erosion leaflet No. 1) entitled "soil erosion — general considerations."

The measures laid down in this leaflet as being necessary for reducing soil erosion to a minimum are:—

(a) Protecting the soil from the beating action of rain water falling directly on to it.

(b) Obtaining the greatest absorption of the rain water by the surface area on which it falls.

(c) Controlling the removal of all surplus rain water.

(d) Making provision for the collection and replacement of any soil which is eroded.

So far as Rubber estates are concerned the problem is a relatively simple one and can be summed up under the headings of ground cover and drainage. The Rubber industry may be regarded as standing midway between the Tea and Coconut industries in regard to the urgency and difficulties of soil conservation measures. In Tea the land is frequently very steep and the bushes afford less protection from the beating action of the rain than Rubber trees. In Tea, also, the choice of suitable cover crops is restricted and the question of competition between the cover and the main crop is probably of greater importance than in Rubber. In the Coconut industry, on the other hand, the land is usually comparatively flat and it has always been customary to maintain a cover of some sort — usually grass — on the land.

MATURE RUBBER AREAS

Problems relating to ground covers and drainage are rather different for mature Rubber areas and young clearings so I will refer to them separately, dealing first with mature Rubber. I will start by saying that we regard any ground cover on a Rubber estate as being better than none and I have no doubt that one of the first questions I shall be asked is "What about grass?" I consider that a grass cover is definitely preferable to bare soil on hilly land but there is no doubt that the grasses, in general, are among the least desirable forms of cover. It has frequently been suggested that grasses have a "toxic" effect on the soil but there is no real evidence that this is the case. It has, however, been shown within recent years that grasses can absorb nourishment from the soil in a more complex chemical form than broad leafed plants and consequently have an advantage in competing for the available foodstuffs. It is on the grounds of competition between the cover and the main crop that grasses, in general, are regarded as undesirable covers.

Before speaking about leguminous ground covers I think you would like to hear something about the so-called "forestry" system of cultivation which has made considerable headway in Malaya. As you know Mr. Murray recently visited Malaya and other rubber producing countries and he has given his impressions of the system in his report which is now in the press.* The aim in the forestry system of cultivation is to establish and maintain a cover of desirable types of indigenous plants, the less desirable growths being gradually eliminated. Desirable types are erect shade-tolerant species with large succulent leaves and deep rooting habit, while the undesirable are varieties with leaves and stems which are resistant to decomposition such as bracken, stagmoss, most grasses, ferns with a tufty root habit and woody "cheddies". The usual method of control is to slash the plants when they reach a height of about 5 feet and to remove those which have become too woody by cutting the stems just below ground level.

Mr. Murray visited one estate in Malaya on which the method had given very satisfactory results and he expresses the opinion that "when the correct type of cover can be grown and proper control exercised the soil is restored to a condition of fertility akin to that in the natural forest." He considered, however, that the work on this estate had been carried out under especially favourable conditions and was less favourably impressed with the results so far achieved on other estates.

In particular he points out that the tempo of the process of soil regeneration is likely to be extremely slow on estates where it is most needed and expresses the view that it will probably be necessary to accelerate the growth of suitable natural cover by manuring.

The question arises whether this system of cultivation, if successful in Malaya would be equally satisfactory under local conditions. This is a matter which can only be settled by experiments but one feature which Mr. Murray draws attention to, is the delay in drying of the tapping cuts in wet weather which would probably be an important factor under local monsoon conditions. His advice, in the light of present knowledge, is that local estates should endeavour to establish leguminous ground covers, in the meantime retaining naturally occurring plants of a desirable type. This includes Rubber seedlings which can be allowed to grow until they reach a height of 6-8 feet

* Rubber Research Scheme Bulletin No. 54.

and are then cut off below ground level. Two other useful local shrubs are "Kenda" (*Macaranga tomentosa*) and "Verraniya" (*Hedyotis fructicosa*).

I think Planters are now generally agreed on the desirability of establishing leguminous ground covers under mature Rubber and if there are still many bare hillsides to be seen on estates it is due rather to the difficulties of establishing and maintaining a cover than to a belief in the advantages of clean weeding. *Vigna* (*Dolichos hosei*) was planted extensively some years ago and grew well but experience has shown that it is not sufficiently hardy to persist under mature Rubber in the absence of periodical manuring. *Pueraria phaseoloides* is a more vigorous species which appears capable of growing under these conditions and we recommend its use for planting in mature Rubber. We made some trials at Dartonfield last year to compare methods of propagating this species. Notes on the subject are being published in the next issue of our *Quarterly Circular** so I will not go into much detail here. We found that the best method of propagation was by means of marcotted cuttings but this method can only be used if the plant is already established on or near the estate. Good results were also obtained by growing the seed in coconut husks which were afterwards planted out in the field. Direct planting of seed in the field gave very poor results. The estimated costs per acre are approximately Rs. 4/- for marcotted cuttings and Rs. 3/- for seed in coconut husks.

I do not propose to say a great deal on the subject of earthworks in mature Rubber. The only steps which can usually be taken are the improvement of existing drainage systems with a view to retaining a maximum proportion of the rainfall on the land and ensuring that the surplus water flows away with a minimum erosive action. In modern practice side drains are cut on the contour and consist of a series of silt pits connected by shallow channels and overflowing into the leader drains. A suitable construction is to cut pits 8 feet long × 1½ feet wide × 2 feet deep. The pits are spaced three feet apart and the intervening bunds are cut away to a depth of 6 inches below ground level. If existing drains have only a slight gradient and are comparatively shallow the requirements of drainage improvement can be met by cutting silt pits similar to those described. This type of improvement has recently been carried out at Dartonfield. If the drains are already too deep to permit the

* *First and Second Combined Quarterly Circular, 1937.*

construction of silt pits without unduly lowering the water table, the same effect can be obtained by the construction of stone and earth bunds at intervals in the drains. Steeper drains up to a gradient of 1:10 can be converted into a series of level stretches by the construction of stone bunds, with or without silt pits behind the bunds to increase the water holding capacity. On similar lines leader drains can be converted from rushing torrents to a series of gentle cascades by the construction of cross walls, to produce what is known as the "step and water cushion" system. Scouring of main drains can also be reduced by stone paving or by the planting of ferns or other suitable plants. I can recommend anyone who is interested in improving the drainage system on his estate to study Bulletin No. 89 of the Department of Agriculture, entitled "Soil Erosion", which has just been published. Very useful descriptions are given of methods for the conversion of drainage systems to meet modern requirements.

REPLANTED AREAS

So much for mature Rubber and I will now turn to considerations relating to the prevention of soil erosion in new clearings or perhaps, under present conditions, I should say replanted areas. Replanting provides a suitable opportunity for the introduction of effective measures for soil conservation and from what I have seen of replanting operations in different districts I think the importance of soil conservation is being adequately recognised.

The establishment of a ground cover forms the first line of defence against soil erosion both in mature Rubber and clearings but as the construction of any form of earthworks which may be decided on, usually precedes the planting of cover crops. I will deal with this subject first.

The first question which arises is whether it is desirable to prevent all run-off of rain water from the land. This is undoubtedly the ideal so far as soil erosion is concerned but whether there are disadvantages in other directions is a subject which awaits further investigation. In zones of very heavy rainfall I am inclined to think there may be a risk of nutrients being leached to lower levels of the soil if the entire rainfall is made to percolate away through the soil and that it may be preferable under such conditions to retain only a proportion of the water on the land. On the other hand in a drier district moisture conservation may well be the most important factor.

The two usual forms of earthworks for retaining the entire rainfall, or the greater part of it, on the land are contour platforms and contour trenches. I do not intend to give detailed descriptions of these methods of opening because they were described in our last *Quarterly Circular*.* We also have roneo-ed copies of notes on the systems which are available to anyone who requires working details. A point which we consider important in replanted areas is that leader drains in the folds of hills should be kept open and spills provided so that surplus water will overflow into the drains from platforms or trenches when it reaches a given level in them. Experience has shown that it is extremely difficult to bridge old drains with platforms or trenches but apart from this we prefer to keep the drains open as a precaution against washaways. An alternate method of retaining the water on the land is by means of a series silt pits of sufficient water holding capacity to cope with the maximum rainfall which can be expected.

If it is only desired to retain a proportion of the rainfall on the land, planting can be done on the contour with level silt pitted drains between the rows, as I described when dealing with drainage in mature Rubber. We have an experiment in progress at Dartonfield to compare 3 methods of opening namely, contour platforms, contour trenches and contour drains, and we are often asked which system we prefer. The answer to that is that we should not be carrying out an experiment to compare the methods if we already knew which was the best. However, we have certain views on the subject based on general observations. On land of moderate slope we think that the provision of contour drains is adequate and that the extra expense of platforms or trenches is unnecessary. On steeper land platforming or trenching is advised and we think that trenches have definite agricultural advantages over platforms. When a platform is cut on steep land there is a relatively high bank at the back of it and the roots of the plant on the inner side are growing into subsoil. The outer side of the platform consists of loose thrown up soil and the general tendency is for the main root development to take place in this area. As the shade of the trees increases the ground covers inevitably thin out and gradual erosion of the edge of the platform leads to root exposure. In the trench system the hole is at almost the natural level in relation to the slope of the hill and the roots can be spread freely in all directions although the main development is at the bottoms of the trenches. It must be admitted that a certain amount of root exposure

* *Fourth Quarterly Circular, 1936.*

occurs in trenched areas later on as the bunds erode but it is less evident than in platformed areas.

As regards water holding capacity, our trenched areas at Dartonfield nominally hold up approximately 3 inches of rain before overflowing into the leader drains but owing to extremely rapid percolation it is very rarely indeed that they overflow. I visited the area recently during a shower in which 2 inches of rain fell within half an hour. There was no run-off from the clearing at all. Even in the area with silt pitted drains which only theoretically hold up a little over 1 inch of rain, the silt pits were only half full.

Turning to the subject of cover crops we suggest that a mixture of creeping and erect types should be sown such as *Calopogonium mucunoides* and *Centrosema pubescens*, *Crotalaria angyroides*, *Tephrosia candida* and *Tephrosia vogelii*. We do not recommend *Pureraria phaseoloides* in clearings as we consider that it is likely to compete unduly with the young Rubber. The erect covers get a good start before the creepers begin to spread, but finally the creepers swamp the erect plants. Pueraria should be planted when the other covers start to thin out under the shade of the developing trees. *Gliricidia maculata* planted between the rows of Rubber provides a useful source of green loppings, and *Albizzia moluccana* is favoured as a protection against wind. We are not in a position to express an opinion at present on the desirability of leaving a small permanent stand of these trees, although cases have been seen in which they appear to have had a distinctly beneficial effect on the Rubber. Weeding need only be of a selective nature for the removal of grass, bracken, mikania and "illuk."

It is thought by some that only bush covers should be grown in clearings with a view to using them as indicators of the presence of sources of root disease infection. It is true that they do form very useful indicators but even in areas planted with mixed seed the erect covers persist for about two years before being overgrown by the creepers. Under normal conditions we should favour the mixed cover as giving better protection to the soil but in areas with a previous history of root disease or where disease becomes evident after replanting I think there is a lot to be said for relying on erect plants until the sources of infection have been eradicated. It may be mentioned incidentally, that root disease treatment is more difficult on platformed and on trenched land than in areas with contour drains.

I have given you a brief summary of the measures which we consider advisable for the prevention of soil erosion in mature Rubber areas and clearings. My impression at the present time is that replanted areas are being dealt with adequately in this direction but that insufficient attention is being given to the improvement of conditions in the older areas. It should be remembered that the local industry will have to depend on its old areas for its profits for many years and that these areas in due course will have to be replanted. I think it is in the interests both of the Proprietors of estates and of the general community that suitable steps should be taken while the industry is on a profitable basis for conserving and regenerating the soil in mature Rubber areas.

MEETINGS, ETC.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the thirty-eighth meeting of the Rubber Research Board held in the Chamber of Commerce Building, Colombo, at 10 a.m. on Thursday, 17th June, 1937.

Present.—Mr. E. Rodrigo, C.C.S. (in the chair), Mr. S. Phillipson, C.C.S., (Acting Deputy Financial Secretary), Messrs. L. B. de Mel, J.P., U.P.M., G. E. de Silva, M.S.C., F. H. Griffith, M.S.C., A. H. Healey, Col. T. G. Jayewardene, V.D., Messrs. F. H. Layard, F. A. Obeyesekere, J. L. D. Peiris, B. M. Selwyn and Col. T. Y. Wright.

Mr. T. E. H. O'Brien, Director, was also present by invitation.

Apologies for absence were received from Mr. J. C. Kelly, Mr. S. F. H. Perera and Mr. C. A. Pereira.

1. MINUTES

Minutes of the thirty-seventh meeting which had been circulated to members were confirmed and signed by the Chairman.

Matters Arising from Minutes.—With reference to item 5 (d) Mr. Selwyn enquired whether the desirability of issuing a leaflet on the depth of tapping had been considered by the Director. The Chairman replied that a note on the subject had been included in the *1st and 2nd Combined Quarterly Circular* which would be published shortly.

2. BOARD

The Chairman reported the following changes in the membership of the Board since the last meeting :—

(a) Mr. I. L. Cameron had been renominated to represent the Rubber Growers' Association for a further period of 3 years from 15th April, 1937.

(b) Mr. F. H. Layard had been nominated to act for Mr. I. L. Cameron during the period of Mr. Cameron's absence from the Island, with effect from 17th March, 1937.

(c) Mr. A. H. Healey had been nominated to act for Mr. E. W. Whitelaw during the period of Mr. Whitelaw's absence from the Island, with effect from 30th March, 1937.

(d) Mr. S. F. H. Perera had been nominated to act for Mr. L. M. M. Dias during the period of Mr. Dias' absence from the Island, with effect from 18th May, 1937.

(e) Mr. S. Phillipson had been deputed by the Hon'ble Mr. C. H. Collins, Acting Financial Secretary to act for him, with effect from 12th June, 1937.

The new members were welcomed by the Chairman.

3. PROPOSED GRANT FROM THE DEPARTMENT OF INDUSTRIES FOR THE PURCHASE OF LARGE SCALE RUBBER MACHINERY

The Chairman reported that a further letter had been received from the Minister for Labour, Industry and Commerce, indicating the requirements of the Executive Committee in regard to the employment of research assistants and the training of research students by the Research Scheme. It was considered impracticable to accept the conditions laid down by the Committee. It was, therefore, decided to withdraw the application for a grant for the purchase of large scale machinery and to abandon the proposal to demonstrate the manufacture of rubber flooring on a semi-commercial scale.

It was agreed that the Board would continue to demonstrate the practicability of the local manufacture of vulcanized rubber products, so far as this could be done with the small scale machinery available at Dartonfield.

4. ACCOUNTS

(a) *Auditor's Report for 1936.*—(1) Covering sanction was given for the following items of over-expenditure in 1936:—

Travelling expenses of Staff	..	Rs 880/-
Pinnagoda seedling nursery	...	,, 131/-

(2) Approval was given for deducting Rs. 49,944·31 (representing the value of the buildings and water fittings which had been sold) from the contribution to capital outlay.

(3) Subject to the approval of the Auditor-General it was decided to adopt the same form of accounts as that used by the Tea Research Institute.

(b) *Statements of Receipts and Payments of the Board and of the London Advisory Committee*—for the quarter ended 31st March, 1937 were adopted.

(c) *Dartonfield and Nivitigalakele Accounts for January and February, 1937*—were tabled.

(d) *Fixed Deposits.*

Reported:—

1. Renewal of a fixed deposit of Rs. 50,000/- at the Chartered Bank of India, Australia and China at 2 per cent. for one year from 20-3-37.

2. Transfer of Rs. 20,000/- on maturity of two fixed deposits with the Hongkong and Shanghai Banking Corporation to current account on 19th and 20th March.

(e) *Investment in Ceylon Government Loan.*—Reported that a sum of Rs. 25,000/- had been invested in the Ceylon Government 3½ per cent. Loan 1957-62, in accordance with a decision reached at the last meeting to invest the Provident Fund balance. As the Provident Fund was a liability of the Board it was preferable to regard the investment as being made from the Board's general funds. This was approved.

The Chairman agreed to prepare a memorandum showing what further part of the Board's funds could be invested in this or similar securities.

(f) *Purchase of Sulphur Dusting Machine.*—Covering sanction was given for the expenditure of Rs. 301·50 on the purchase of a Noidium dusting machine which had been taken over by the Research Scheme when the machines used for the sulphur dusting demonstration in 1936, were sold recently. Sanction was also given for the sale of 2 older machines by private tender, after advertisement in the press.

5. TECHNICAL OFFICERS' REPORTS FOR THE QUARTER ENDED 31ST MARCH, 1937

The reports were adopted. Referring to the Assistant Chemist's report the Chairman pointed out that Mr. Philpott had succeeded in making rubber tiles which were extremely resistant to moisture absorption.

6. EXPERIMENTAL COMMITTEE

The following decisions were reached regarding recommendations of the Committee :—

(a) *Junior Staff Bungalows.*—Decided that bungalows to be built on the present site at Dartonfield should be of the same type as those already erected but that bungalows to be built at Nivitigalakele should be of a simpler type to cost Rs. 3,500/- inclusive of furniture.

(b) *Demolition of Culloden Buildings.*—Decided that the laboratory at Culloden be demolished and the materials be used in the Estate Office and other minor buildings at Dartonfield. It was noted that there would be a nett saving of approximately Rs 1,000/-.

(c) *Furniture for Conductor's Quarters.*—A sum of Rs. 276·25 was voted to bring the furnishing of these quarters up to the standard laid down by the Board for junior staff bungalows.

(d) *Compost Manure.*—Agreed that the question of laying out an experiment to compare the relative values of compost and other fertilisers be deferred until a Soil Chemist is appointed. One member asked for his dissent from the decision to be recorded.

(e) *Manufacture of Vulcanized Products.*—Decided that small vulcanized rubber articles such as rubber tubing and cord, erasers, squeegee rubbers, also rubber paint should be manufactured at Dartonfield on a semi-commercial scale and sold retail through the Commissioner for Agricultural Marketing. Approval was given for the employment of a vulcanizing foreman at Rs. 30/- per month and an assistant at Rs. 20/- per month. Advance expenditure up to Rs. 600/- was approved and Rs. 250/- was voted for the purchase of necessary equipment.

(f) *Variability of Raw Rubber.*—Consideration was given to a letter from the Secretary of the London Advisory Committee for Rubber Research (Ceylon and Malaya) suggesting that work on the variability of raw rubber should be undertaken. On the recommendation of the Experimental Committee it was decided that work on the subject should be undertaken locally and a sum of Rs. 5,500/- was voted for the purchase of an autoclave vulcanising press etc.

(g) *Wagolla Farm School, Kegalle.*—Approval was given to a proposal for test-tapping 211 budded trees at the above station which had been placed at the disposal of the Research Scheme by the Assistant Government Agent, Kegalle, on the recommendation of the Director of Agricuture. A sum of Rs. 430/- was voted to cover expenditure during the current year and it was noted that a sum of approximately Rs. 230/- would be recovered by the sale of rubber from the station.

7. STAFF

(a) *Botanist and Mycologist.*—Reported that Mr. R. K. S. Murray had accepted re-engagement on the terms previously approved.

(b) *Small-Holdings Propaganda Officer.*—Reported that Mr. W. I. Pieris had been granted 3 months' special leave for urgent personal reasons. It had been necessary to discontinue the work of the Rubber Instructors as no suitable arrangements could be made for supervision during his absence.

(c) *Geneticist.*—The following Committee was elected to consider the applications for the post of Geneticist and make a recommendation to the Board: the Chairman of the Board (Mr. E. Rodrigo), the Chairman of the Experimental Committee (Mr. F. H. Griffith), Colonel T. G. Jayewardene, V.D.

(d) *Additional Clerk for Head Office.*—Agreed to appoint a junior clerk on the scale Rs. 40/- Rs. 5/- Rs. 80/- per month.

8. SALE OF PLANTING MATERIAL IN 1938

Decided to adopt the Director's recommendation that applications for budded stumps in 1938 should be limited to 500 plants, with a maximum of 100 of one clone. Applications should be called for by advertisement and the material allocated on a *pro rata* basis. The price and conditions of sale would be the same as in 1937.

9. TRAINING IN BUDGRAFTING

Reported that arrangements had been made to hold courses of training for estate employees at fortnightly intervals, starting early in July. It was agreed that other selected applicants should be trained when the demand for the training of estate employees had been satisfied.

10. LATEX CONCENTRATION

A sum of Rs. 3,000/- was voted for the purchase of a centrifuge to enable experimental work to be undertaken on the concentration of latex by the centrifugal process.

The meeting terminated with a vote of thanks to the Ceylon Chamber of Commerce for the use of the Committee room.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the thirty-ninth meeting of the Rubber Research Board held in the Committee room of the Ceylon Chamber of Commerce, Colombo, at 9 a.m. on Thursday, 29th July, 1937.

Present.—Mr. E. Rodrigo, C.C.S. (in the chair), Mr. S. Phillipson, C.C.S., (Acting Deputy Financial Secretary), Messrs. L. B. de Mel, J.P., U.P.M., F. H. Griffith, M.S.C., A. H. Healey, Col. T. G. Jayewardene, V.D., Messrs. J. C. Kelly, R. C. Kannangara, M.S.C., F. H. Layard, C. A. Pereira, S. F. H. Perera, J. L. D. Peiris, E. C. Villiers, M.S.C. and Col. T. Y. Wright.

Mr. T. E. H. O'Brien, Director, was also present by invitation.

Apology for absence was received from Mr. B. M. Selwyn.

1. MINUTES

Minutes of the thirty-eighth meeting which had been circulated to members were confirmed and signed by the Chairman.

2. BOARD

Mr. S. F. H. Perera was welcomed to the Board by the Chairman.

3. STAFF

(a) *Geneticist.*—Reported that 12 applications had been received for the post of Geneticist: three from Ceylon and India and nine from abroad. The Sub-Committee appointed to consider the applications had selected two candidates from abroad and had recommended that the London Advisory Committee for Rubber Research (Ceylon and Malaya) should be asked to make a final selection after interviewing the candidates. The recommendation was adopted.

(b) *Chemist.*—Reported that Mr. M. W. Philpott's service agreement would terminate shortly and it was necessary to consider the question of his re-engagement. It was decided to offer Mr. Philpott re-engagement on the terms previously approved for officers recruited from abroad and to alter his designation from Assistant Chemist to Chemist.

(c) *Soil Chemist.*—The decision reached earlier in the year to postpone the appointment of a Soil Chemist was reviewed and it was decided to make the appointment.

4. ACCOUNTS

(a) *Dartonfield and Nivitigalakele Accounts* for March and April, 1937 —were tabled.

(b) *Supplementary Estimates 1937.*—Supplementary estimates for 1937, totalling Rs. 2,106·11 were approved. It was noted that there would be a corresponding saving under other heads of expenditure.

5. EXPERIMENTAL COMMITTEE

The following decisions were reached regarding recommendations of the Committee :—

(a) *Dartonfield Factory.*—Decided that a consulting engineer be asked to inspect the factory and advise on measures for protecting the electrical equipment from the risk of lightning damage.

(b) *Nivitigalakele Office.*—Minor alterations were approved at a cost of Rs. 33/-.

(c) *Nivitigalakele Assessment.*—Decided to apply to the Rubber Controller for special assessment as a budded area.

(d) *Compost Manuring.*—Proposals were approved for a preliminary experiment to compare the effects of compost manure and concentrated fertilisers in the 1935 clearing at Pinnagoda.

6. MANUFACTURE OF RUBBER GOODS

Arising from the decision to manufacture vulcanized products for sale through the Agricultural Marketing Commissioner, the Chairman reported that it would be possible to take one student for a 6 months' course of training in rubber technology. The Director was authorized to select a suitable person for training after advertising the vacancy.

7. IMPORTATION OF CLONAL SEED AND BUDWOOD

Reported receipt of a letter from the Rubber Controller, stating that an application had been made to the International Rubber Regulation Committee for permission to import planting material to Ceylon.

The meeting closed with a vote of thanks to the Ceylon Chamber of Commerce for the use of the Committee room.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the fortieth meeting of the Rubber Research Board held in the Committee room of the Ceylon Chamber of Commerce, Colombo, at 10 a.m. on Tuesday, 26th October, 1937.

Present.—Mr. E. Rodrigo, C.C.S. (in the chair), Mr. C. H. Collins, C.C.S. (Deputy Financial Secretary), Messrs. L. B. de Mel, J.P., U.P.M., G. E. de Silva, M.S.C., R. J. Hartley, A. H. Healey, Col. T. G. Jayewardene, V.D., Messrs. J. C. Kelly, R. C. Kannangara, M.S.C., F. A. Obeyesekere, S. F. H. Perera, C. A. Pereira, J. L. D. Peiris, B. M. Selwyn and Col. T. Y. Wright.

Mr. T. E. H. O'Brien, Director, was also present by invitation.

Apologies for absence were received from Mr. E. C. Villiers, M.S.C. and Mr. F. H. Griffith, M.S.C.

1. MINUTES

Minutes of the thirty-ninth meeting which had been circulated to members were confirmed and signed by the Chairman.

2. BOARD

(a) *Nomination of Mr. R. J. Hartley to act for Mr. I. L. Cameron.*—The Chairman reported that the Rubber Growers' Association had nominated Mr. R. J. Hartley to act for Mr. I. L. Cameron from 15th September in place of Mr. F. H. Layard who was leaving the Island.

(b) *Resumption of Office by Mr. C. H. Collins, C.C.S.*—The Chairman reported that Mr. C. H. Collins, Deputy Financial Secretary, had resumed his seat on the Board on 13th October, relieving Mr. S. Phillipson.

Mr. Hartley was welcomed to the Board by the Chairman.

3. SMALL-HOLDINGS COMMITTEE

Minutes of a meeting held on August 21st were considered. It was decided to accept the Committee's recommendation to extend the work of the Small-holdings Department by the appointment of 4 additional Rubber Instructors who will be stationed at or near the following centres: Matale, Avisawella, Ratnapura, Galle. A proposal to appoint 6 additional Instructors was not supported.

The following salary scale was approved:—

Probationary period of 1 year — Rs. 60/- per month. Subsequent scale: Rs. 70/- per month rising by annual increments of Rs. 5/- to Rs. 115/- per month with an efficiency bar at Rs. 100/-.

4. EXPERIMENTAL COMMITTEE

Minutes of a meeting held on September 28th, 1937, were considered.

(1) *Tennis Court.*—A supplementary vote of Rs. 277/- for completion of the tennis court, was approved.

(2) *Growth and Yield at Nivitigalakele.*—A memorandum by the Director giving details of the growth and yield of budded trees at Nivitigalakele was adopted. It was noted that the rate of growth is approximately similar to that of other budded areas in Ceylon, planted during the same period.

(3) *Protection of Electrical Equipment from Lightning Damage.*—A vote of Rs. 200/- was approved for the installation of lightning arrestors of the surge absorber type on the main transmission line at Dartonfield.

5. ACCOUNTS

1. *Estimates of Income and Expenditure for 1938.*—Draft estimates which had been circulated to members were considered in detail. After discussion the following estimates were adopted:—

Revenue			Rs. 228,000
Expenditure on revenue account		Rs. 183,031	
Expenditure on capital account:—			
Buildings	Rs. 47,800		
Equipment	,, 3,990		
Agricultural Development	,, 2,281	Rs. 54,071	Rs. 237,102
Estimated available cash balance at December 31st, 1938 ...			Rs. 97,862

2. *Statements of Receipts and Payments of the Board and the London Advisory Committee*—for the quarter ended 30th June, 1937, were approved.

3. *Dartonfield and Nivitigalakele Accounts*—for May, June and July, 1937, were tabled.

4.—*Investment of Funds.*—A memorandum prepared by the Director was considered. Approval was given to the proposal that a sum approximating to the balance of the Depreciation and Provident Fund reserves should be invested in long term securities, provided that the sum so invested does not at any time exceed 50 per cent. of the Board's total funds. It was left to the Chairman to make suitable investments in consultation with the Treasury representative on the Board.

6. STAFF

1. *Mr. R. K. S. Murray.*—Reported that the Chairman had allowed an application for one month's extension of leave on medical grounds. This action was confirmed.

2. *Mr. M. W. Philpott.*—Reported that Mr. M. W. Philpott had accepted re-engagement as Chemist for a further period of service from 13th April, 1937, when his present agreement terminates. Approval was given for Mr. Philpott to proceed on leave in April next and to receive proportionate additional leave for the period of service from October, 1937 to April, 1938.

3. *Appointment of Geneticist.*—Reported that the 2 candidates selected for interview at the last meeting had accepted other appointments in the meantime. A third candidate had since been selected by the Committee but it was found that his services, also, were not available. It was decided to ask the London Advisory Committee for Rubber Research (Ceylon and Malaya) to re-advertise the vacancy and select a candidate for appointment.

7. TRAINING IN RUBBER TECHNOLOGY

The Chairman reported that, as decided at the last meeting, an advertisement had been issued in the local papers for a man to be trained in the technology of rubber manufacture. Four applications had been received

but the candidates were not of the type required. It was decided that the position should be reported to the Executive Committee for Labour, Industry and Commerce and that the Committee be invited to nominate a candidate for training.

8. TECHNICAL OFFICERS' PROGRESS REPORTS FOR THE QUARTER ENDED 30TH JUNE, 1937

The reports were adopted.

9. LONDON ADVISORY COMMITTEE

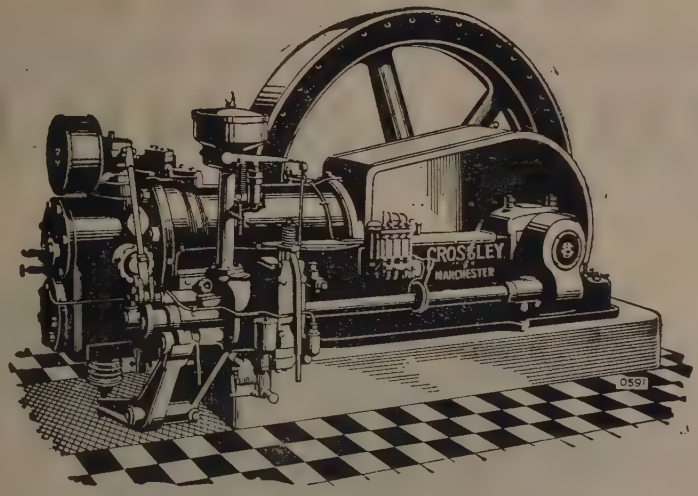
1. The Chairman reported that Mr. Eric Macfadyen and Mr. J. L. Milne had been nominated as representatives for Malaya on the Committee in the place of Mr. H. Eric Miller and Mr. W. J. Gallagher who had resigned.

2. Minutes of meetings of the Committee and the Technical Sub-Committee held on 30th April, 1937, were adopted.

10. INSTITUTION OF THE RUBBER INDUSTRY

A letter was read inviting the Scheme to participate in a Rubber Technology Conference to be held in London from 23rd to 25th May, 1938. It was decided to ask Mr. M. W. Philpott to attend the conference.

The meeting terminated with a vote of thanks to the Chair and to the Chamber of Commerce for the use of the Committee room.



CROSSLEY
ENGINES

FOR

ALL REQUIREMENTS

RELIABILITY—ECONOMY

LONG LIFE

Walker & Greig, Ltd

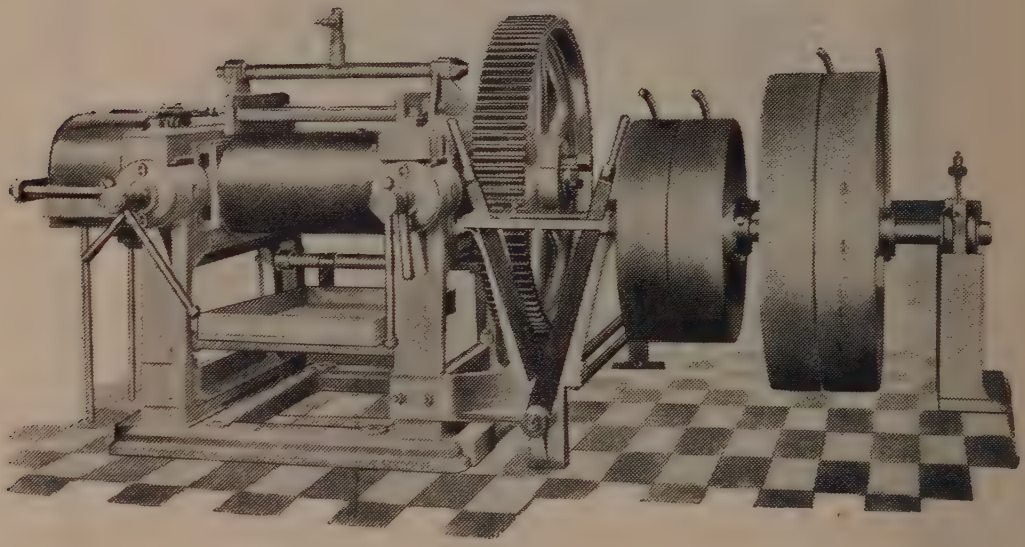
ENGINEERS

COLOMBO AND BRANCHES

WALKERS

WASHING, CREPING AND SHEETING

RUBBER MILL



The design of this machine is based on practical experience gained on Rubber Estates, and it embodies improvements suggested by results obtained from previous models. Only the best materials are used in its construction. All the working parts are placed above ground level. The driving shaft and pulleys are at the back of the machine and at a height clear of all water.

MACHINE CUT GEARS—SILENT RUNNING

FITTED WITH SPECIAL SAFETY BUSHES

Full Particulars and Prices will be sent on request.

WALKERS — COLOMBO.

SULPHUR DUSTING

FOR USE WITH THE

C. C. C. "NOIDIUM" MACHINE

(As used by the Rubber Research Scheme)

We recommend

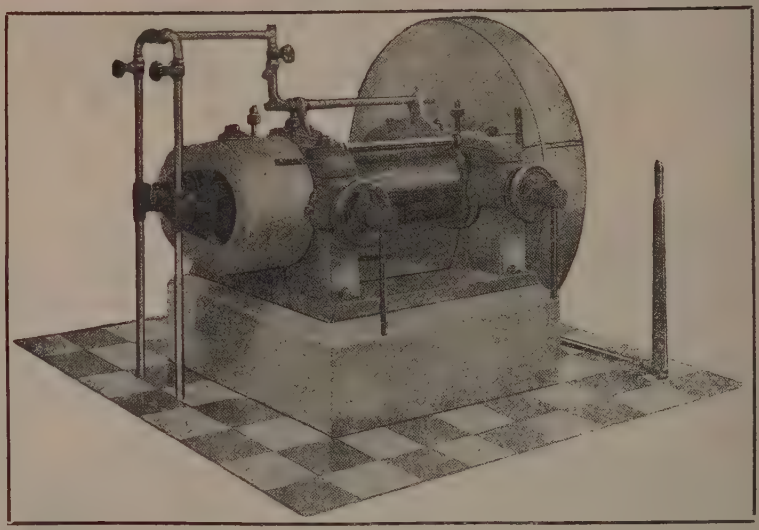
COOPER'S SPECIAL SPREADING SULPHUR

THE

COLOMBO COMMERCIAL Co., Ltd.

COLOMBO, BADULLA, KANDAPOLA, KANDY, HATTON.

RUBBER MACHINERY



Makers of Rubber Creping and Washing Mills, Scrap Washing and Sheeting Mills.

Sole Agents in Ceylon for

Messrs. David Bridge's Rubber Machinery

THE

COLOMBO COMMERCIAL Co., Ltd.

COLOMBO, BADULLA, KANDAPOLA, KANDY, HATTON

REPLANTINGS,

(SEEDLING or BUDGRAFT)

YOUNG RUBBER,

AND

OLD RUBBER,

ALL REQUIRE CORRECT

MANURING

THE **BEST FERTILISERS** FOR

ALL STAGES OF GROWTH

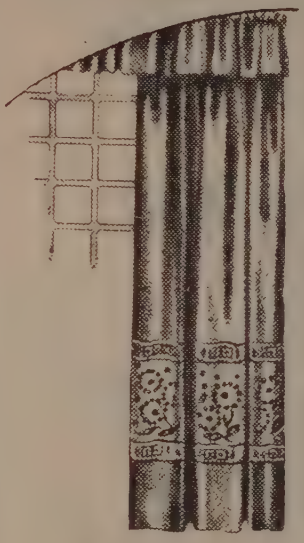
RECOMMENDED AND SUPPLIED BY

THE

COLOMBO COMMERCIAL COMPANY,

LIMITED.

MODERN FURNISHINGS



BY

BROUGHAMS

NEW CARPETS
NEW RUGS
NEW ART
FABRICS
DISTINCTIVE
AND
EXCLUSIVE

BROUGHAMS YORK ARCADE

For Rates and Particulars of Advertisements in

The Quarterly Circular

apply to:—

The Director

Rubber Research Scheme,

Dartonfield,

AGALAWATTA.

WAKEFIELD

PATENT Castrol

MOTOR OIL

All over the world discriminating motorists, like Sir Malcolm Campbell, use only Patent Castrol. They know, that although the advantages of using Patent Castrol are numerous, it costs no more than any other high grade oil. Why hesitate any longer? Ask any man who uses Patent Castrol now. He will tell you, as we do, that it is the best insurance against engine trouble. Tell your service garage to fill up with Castrol next time your car is with them. You will never regret this important step.

RUBBER

Replanting

Success follows the use of

Sterilised Animal Meal BLACK LABEL

in the planting holes.

FOR DETAILS APPLY TO

BRITISH FERTILISERS LTD.

SHAW WALLACE & Co.

MANAGING AGENTS

PARAKRAMA & Co.,

ENGINEERS

CEYLON ENGINEERING WORKS

P. O. Box 102

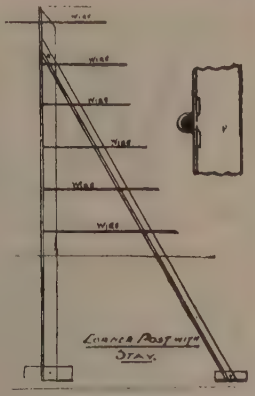
For

RUBBER FACTORIES
SMOKE HOUSES

ESTATE BUNGALOWS
LINES AND LATRINES
HAND RUBBER ROLLERS

C. I. ESTATE NAME BOARDS
REPAIRS TO MACHINERY

ALL WORK DONE UNDER EXPERT SUPERVISION.

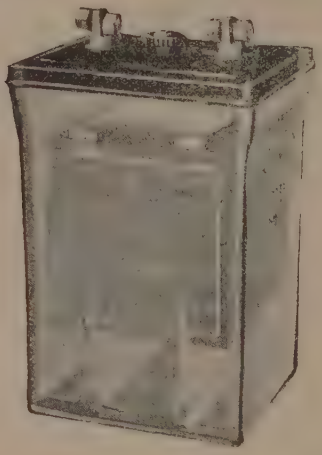


Angle Iron Fence Posts. The Most durable substantial and economical post in the Market. Painted Red, Black or Green.

BATTERIES

Willard

HIGH CAPACITY BUNGALOW BATTERIES



GIVE

MORE LIGHT & POWER FOR APPLIANCES

THEY COST LESS BECAUSE THEY LAST LONGER & PERFORM BETTER

BOUSTEAD BROS.

(Agents:—C. E. T. & L. CO., LTD.)

UNION PLACE COLOMBO

WILL BE PLEASED TO FORWARD FURTHER INFORMATION ON REQUEST

A Pukka Light

It must be a

CROMPTON

COILED-COIL LAMP

These all-British lamps are famous for far-flung brilliance because the special Crompton Coiled-Coil filament gives up to one-fifth more light for the same current consumption. There is a Crompton Stockist near you—see him today.

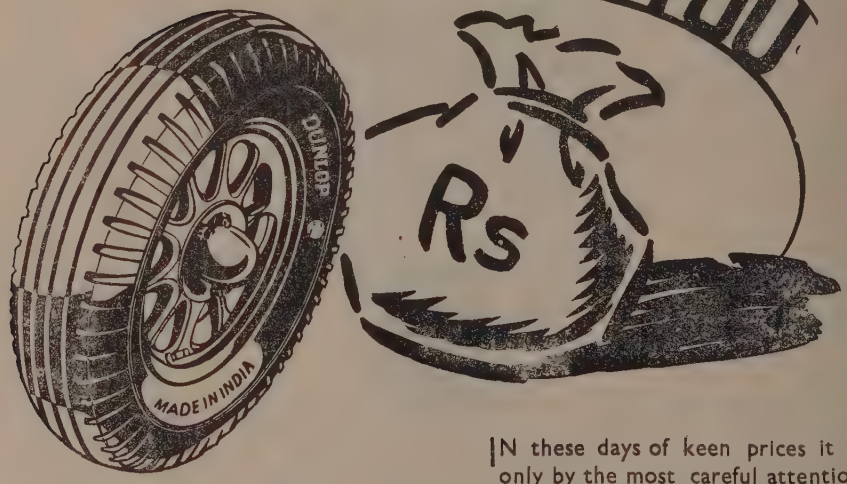
THE LAMP OF LASTING BRILLIANCE

BOUSTEAD BROS. COLOMBO.

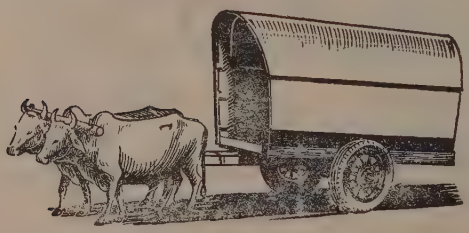
Fitting DUNLOP

BULLOCK CART TYRE EQUIPMENT

MEANS MONEY TO YOU



IN these days of keen prices it is only by the most careful attention to overhead costs that greater profits can be achieved. We can prove that Dunlop Bullock Cart Tyre Equipment will cut your transport and road maintenance costs.



Write for free booklet and full particulars to any Dunlop Depot or direct to P.O. Box No. 391 Calcutta.

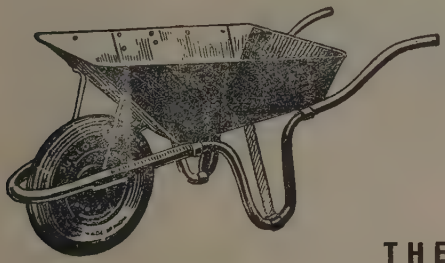
NOW MADE IN INDIA

B C. T. 39

DUNLOP

BARROW & TROLLEY EQUIPMENT

DUNLOP Barrow and Trolley Equipment has been designed by experts, and is worthy in every way of the name of Dunlop. A comprehensive range of sizes in both pneumatic and cushion types is available, ranging from 6″ × 2″ upwards. It has an amazingly long life, halves labour costs and completely eliminates damage to flooring



Write for full descriptive booklet to:—

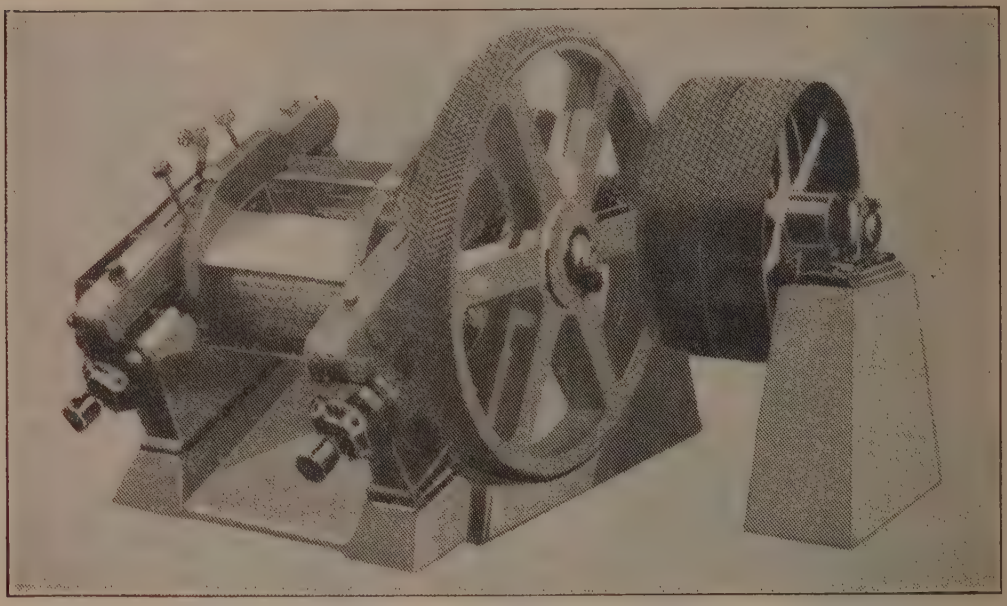
THE

DUNLOP RUBBER CO. (INDIA) LTD.

CALCUTTA BOMBAY LAHORE DELHI
MADRAS KARACHI COLOMBO RANGOON

B.C.T.E. 40.

BROWN'S
NEW PATTERN RUBBER MILL



As supplied to the Rubber Research Scheme Factory

Manufactured in our own Works in Colombo

The rolls are 26 ins. long and 14 ins. diameter

REPAIRS

Carried out during Wintering Season

GROOVING CHILLED ROLLS OUR SPECIALITY

APPLY FOR FULL PARTICULARS:

BROWN & CO., LTD
ENGINEERS & MERCHANTS.

DARLEY ROAD — COLOMBO.

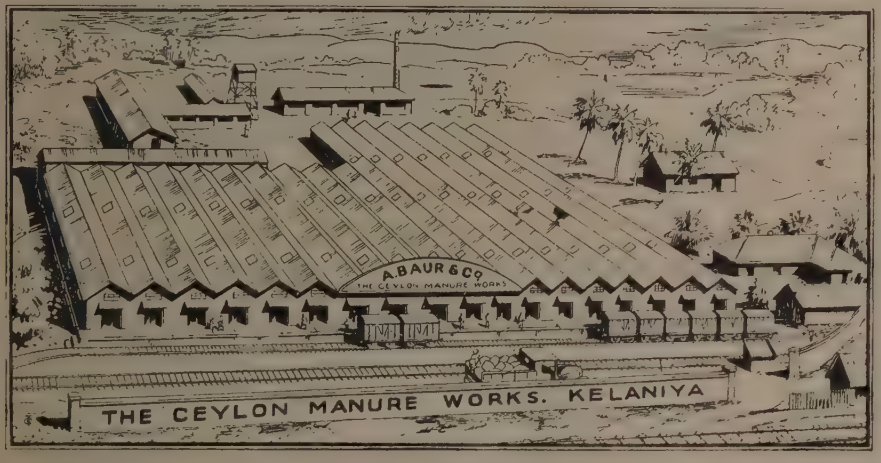
MAKE **RUBBER** PAY

BY GIVING YOUR TREES THE REQUIRED

PLANT-FOOD, SUPPLIED IN **BAUR'S**

SPECIAL RUBBER FERTILISERS

BAUR'S "ELECTRIC" DUSTING SULPHUR WILL CHECK OIDIUM DISEASE ON YOUR ESTATE



A. BAUR & CO.

COLOMBO.

Prince Street, 10. P.O. Box No. 11

LOCAL MANUFACTURE OF VULCANISED RUBBER ARTICLES

PRODUCE

OF THE

EXPERIMENTAL FACTORY,

DARTONFIELD.

To demonstrate the methods used for converting raw rubber into finished goods, the Experimental Plant at the Rubber Research Scheme Factory is being used for manufacturing a small range of articles of general utility

PENCIL ERASERS

TABLE MATS

RUBBER TUBING

SQUEEGEES

RUBBER PAINT

LOCAL MANUFACTURE OF VULCANISED RUBBER ARTICLES

These products are already being supplied to Government Departments and Official Organisations and are now on sale to the public

AT THE

CEYLON PRODUCTS SHOWROOM

CHATHAM STREET — COLOMBO

(Price list available on request).

Waterproof Budgrafting Strip will be available shortly

For further particulars communicate with

The Director

RUBBER RESEARCH SCHEME

DARTONFIELD, AGALAWATTA

London Advisory Committee for Rubber Research (Ceylon and Malaya).

Member nominated by the Colonial Advisory Council of Agriculture and Animal Health.

Sir Frank Stockdale, K.C.M.G., C.B.E.

Member nominated by the Government of Ceylon.

Dr. W. Youngman, D.Sc., Ph.D.

Member nominated by the Governments in British Malaya.

Mr. J. Lornie, C.M.G.

Members representing Malayan Planting interests — nominated by the Rubber Growers' Association.

Mr. P. J. Burgess (Chairman)
Mr. J. L. Milne.
Mr. Eric Macfadyen.

Members representing Ceylon Planting interests — nominated by the Rubber Growers' Association.

Sir Herbert Wright
Mr. G. H. Masefield
Mr. George Brown.

Member representing Manufacturing interests.

Lieutenant-Colonel J. Sealy Clarke.

Ex-Officio Members.

Sir H. A. F. Lindsay, K.C.I.E., C.B.E., Director of the Imperial Institute.
Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology.
Mr. S. F. Ashby, Director of the Imperial Mycological Institute
Sir John Russell, O.B.E., Director of the Rothamsted Experimental Station.

Secretary.

Mr. J. A. Nelson, B.Sc.

The Technical Sub-Committee consists of members of the Advisory Committee with the following co-opted Members.

Mr. G. Martin (Superintendent of Rubber Investigations).
Mr. G. E. Coombs
Mr. Ian. D. Patterson
Mr. B. D. Porritt.
Mr. H. N. Ridley
Mr. W. C. Smith
Dr. H. P. Stevens
Dr. D. F. Twiss
Prof. R. G. H. Clements.

STAFF.

Mr. G. Martin, B.Sc., A.I.C., F.I.R.I.
Mr. W. S. Davey, B.Sc., A.I.C., F.I.R.I.
Mr. H. C. Baker, M.Sc., A.I.C., A.I.R.I.

RUBBER RESEARCH SCHEME (CEYLON)

LIST OF PUBLICATIONS FOR SALE.

Bulletins No. 1-20. Bound volume **Rs. 5-00. Later Bulletins Re. 1-00** per copy

No. 1.	The Effect of Tapping on the Movements of Plant-Food in *Hevea Braziliensis*.	
No. 2.	The Effect of Tapping on the Movements of Plant-Food in *Hevea Braziliensis*.	
No. 3.	Seasonal Variations in the Movements of Plant-Food in *Hevea Braziliensis* Part I.	
No. 4.	The Physiological Effects of Various Tapping Systems, Part I.	
No. 5.	Progress Report on Vulcanization Tests	
No. 6.	The Physiological Effects of Various Tapping Systems, Part II.	
No. 7.	The Physiological Effects of Various Tapping Systems, Part III.	
No. 8.	Seasonal Variations in the Movements of Plant-Food in *Hevea Braziliensis* Part II.	
No. 9.	Vulcanization Tests.	
No. 10.	Vulcanization Tests.	
No. 11.	Variability in Rubber Manufacture.	
No. 12.	Progress Report of the Rubber Research Chemist.	
No. 13.	Vulcanization Tests.	
No. 14.	On the Variation in the Number of Latex Vessels present in *Hevea Braziliensis*.	
No. 15.	Vulcanization Tests.	
No. 16.	On the Natural Clotting of Rubber Latex.	
No. 17.	Vulcanization Tests.	
No. 18.	Measurements of "Bark Renewal."	
No. 19.	Vulcanization Tests.	
No. 20.	Vulcanisation Tests.	
No. 21.	Vulcanisation Tests.	1919
No. 22.	Vulcanisation Tests.	1919
No. 23.	Vulcanisation Tests.	1920
No. 24.	Vulcanisation Tests.	1920
No. 25.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1921
No. 26.	Results of Trials of Ceylon Plantation Rubber for the Manufacture of Ebonite.	1921
No. 27.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1921
No. 28.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1922
No. 29.	Summary of the Principal Results Obtained from Investigations into the Properties of Ceylon Plantation Rubber in Relation to its Method of Preparation.	1922
No. 30.	The Penetration of Disinfectant on the Tapping Cut of *Hevea Braziliensis*.	1922
No. 31.	On the Occurrence of "Rust" on Sheet Rubber.	1923
No. 32.	On the Preservation of Latex.	1924
No. 33.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1924
No. 34.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1924
No. 35.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1924
No. 36.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1924
No. 37.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1924
No. 38.	Investigations on Samples of Plantation Para Rubber from Ceylon.	1925
No. 39.	Do. (Final Report Series 1.)	1925
No. 40.	Do. Series II.	1926
No. 41.	Do. First Interim Report on Artificial Ageing Tests.	1926
No. 42.	On the Smoking of Sheet Rubber in Relation to Mould Prevention.	1926
No. 43.	The Inter-Relationship of Yield and the Various Vegetative Characters in *Hevea Braziliensis* (out of print).	1926
No. 44.	The Construction of Smokehouses for Small Rubber Estates, (out of date).	1926
No. 45.	The Efficiency of Disinfectants and Fungicides.	1927
No. 46.	The Control of Bark Rot by Disinfectants.	1927
No. 47.	Report on Variability of Ceylon Estate Grades.	1927
No. 48.	Brown Bast and its Treatment.	1928
No. 49.	Report on Causes of Variation in Plasticity.	1928
No. 50.	Crepe Rolling.	1929
No. 51.	The Curing of Sheet Rubber.	1930
No. 52.	The Preparation of Uniform Rubber.	1932
No. 53.	Oidium Leaf Disease.	1936
No. 54.	Report on a Visit to Malaya, Java and Sumatra.	1937

Booklets at Rs. 2-50 per copy.

Guide to the Preparation of Plantation Rubber, by T. E. H. O'Brien, M.Sc., A.I.C., Chemist.

The Budding of Rubber, by R. A. Taylor, B.Sc., Physiological Botanist. (out of date).

Diseases of Rubber in Ceylon, by R. K. S. Murray, A.R.C.Sc., Mycologist.

Copies of the following publications of the Rubber Research Institute of Malaya are available at the prices indicated:—

Planting Manual No. 4—Latex Preservation and Shipment **Rs. 3-50.**

Planting Manual No. 5—The History and Description of Clones of *Hevea Braziliensis*. **Rs. 5-00.**